Insight into the Past, Present and Future Evolution of Wax Lake Delta Using a Physics-Based, 3-D Numerical Model

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Recently, Wellner et al. (2005) proposed a model for the development of Wax Lake Delta (WLD), the western most delta in the Mississippi Delta Complex. This model relied on the interpretation of historical aerial photographs and numerous sediment cores. From these data, the authors proposed that WLD is composed of a hierarchical suite of depositional bodies (mouth bars and lobes) that have statistically similar morphologies and internal grain-size trends. Furthermore, these authors hypothesized that jet-type flow was an important component in the development of the mouth bars. This interpretation, however, could not be confirmed due to the lack of velocity data from the often times hazardous channel mouths of WLD. Thus, how can the importance of the WLD's fluid flow field be tested, and a model of deposition generated, in the absence of long-term flow data? One way to resolve this issue is to numerically model WLD using historical and seasonally fluctuating flow data from Wax Lake outlet. Through the application of a physics-based, 3-D basin model coupled to a depth averaged fluid and sediment transport model we attempt to reproduce the depositional history of WLD. Through the use of known and published physical parameters for Wax Lake outlet, we are in the process of analyzing: a) the character of fluid flow and it's evolution under varying morphologic conditions at the mouths of distributary channels, b) the morphological expression and internal stratigraphy of our computer generated mouth bars, c) the genesis and distribution of in-channel and channel mouth scour pools, d) the effect of mouth bar related flow ponding (i.e. back water effect of Hoyal and Sheets (2009)) and splitting associated with mouth bar emplacement, and e) the temporal fluid flow field evolution during the development of our numerical WLD. This integrated study that attempts to numerically model a well known modern depositional system will provide new insight into the hydrodynamic, sedimentary, and stratigraphic evolution of deltaic systems.